Directional spool valves

2.1 Directional spool valve type SW, SWP and NSWP

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers.
The directional spool valve type NSWP and SWP is available as a manifold mounting valve. Type NSWP is available with a nominal size 6 hole pattern (NG 6). Type SW is available as a single valve for pipe connection. The directional spool valve type NSWP can be flexibly adapted to different control tasks by means of additional functions in the pump line and/or on the consumer side (e.g. restrictors, restrictor check valves).
Intended applications for the directional spool valve type NSWP, SWP and SW include industrial hydraulics, in particular machine tools.

Features and benefits:

- Compact valve banks possible
- Proportional functions easy to control
- Large range of variants
- Can be combined with NG6 sub-plates (type BA2)

Intended applications:

- Machine tools
- Construction and construction materials machinery
- Offshore and marine technology
- Road vehicles

Nomen-clature:	Directional spool valve
Design:	Individual valve for pipe connection Individual manifold mounting valve Valve bank manifold mounting Combination with hydraulic power packs
Actuation:	Solenoid
p_{max}:	315 bar
Q_{max}:	25 l/min

Design and order coding example

NSWP2 | G | /M | /R | / ABR1,0 | /50 | /G24 | - 3/8

Single connection block for direct installation in the pipe G 3/8 (type NSWP and SWP2)

Voltage of the actuation solenoids 12V DC, 24V DC, 110V AC, 230V AC
- Solenoids with various plug versions

Pressure switch or pressure gauge at A or B

Additional elements at A and/or B Restrictor check valve or orifice

Additional elements at P Check valve or orifice

Solenoid version
- black/white solenoid or proportional solenoid
- Solenoid with detent
- Solenoid version conforming ATEX (p_{max} = 210 bar)

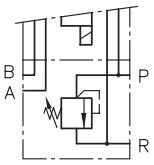
Function
- Indiv. valve with check valve or orifice in gallery P and/or check valve in gallery R (type SWP)
- Indiv. valve with 6/2-way function

Basic type, size Directional spool valve SW, SWP size 1 and 2
NSWP size 2, connection hole pattern NG 6 (CETOP)

Function

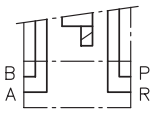
Sub-plate for pipe connection

- 1/4 S(R)



Sub-plate with pressure limiting valve[1)]

- 3/8



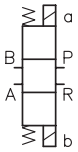
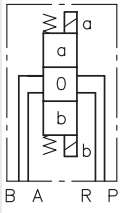
Sub-plate[2)]

1) Only for type SWP 1
2) Only for type NSWP and SWP 2

Valve sections

Basic symbol

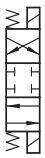
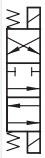
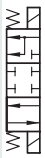
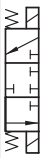
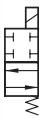
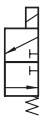
Individual valve

SW	SWP / NSWP
	

Valve sections

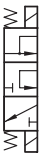
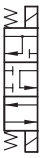
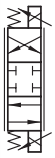
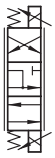
Circuit symbol

May be connected either in parallel or in series within a valve bank

G	D	E	O	C[3)]	N	B	W	K	Q	R[3)]	U[3)]
											

Only connected in series within a valve bank (only type SW1)

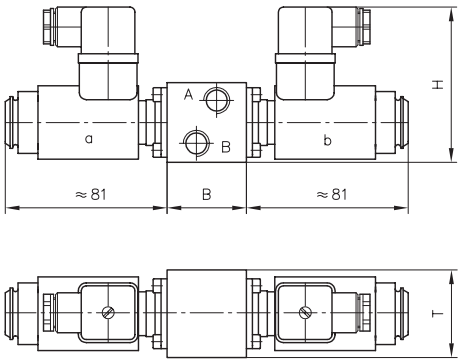
Spool for proportional adjustment

L	F	H	S	Y	G	D
						

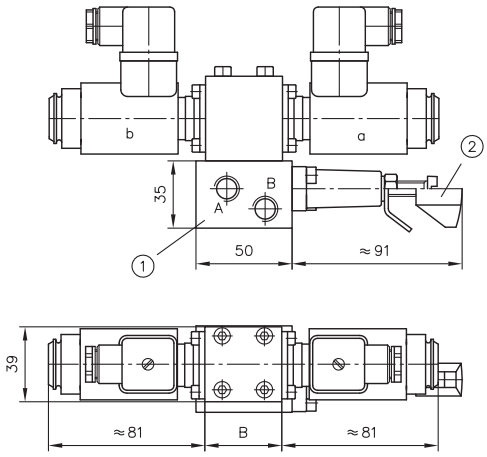
3) Only for type SWR 1

General parameters and dimensions

SW



SWP/NSWP2



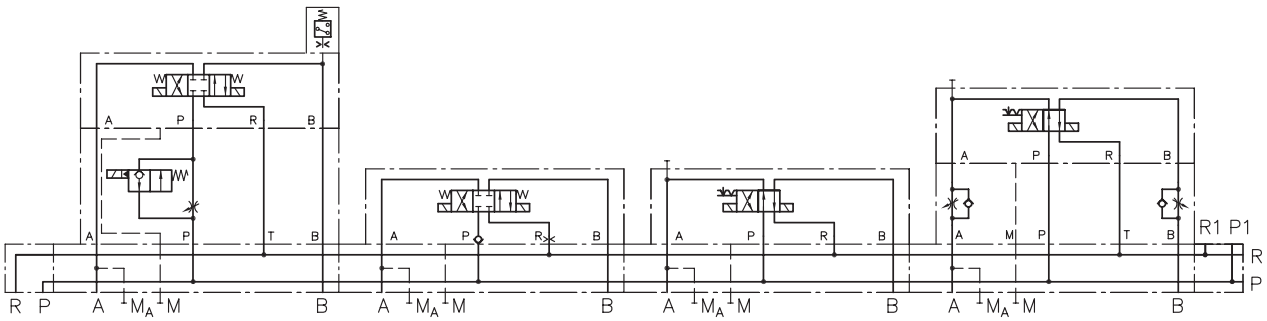
1 Single connection block

2 Pressure-limiting valve

	Q_{max} [lpm]	p_{max} [bar]	Ports	Dimensions [mm]			m [kg]	
				H	B	T	Individual directional spool valve	Sub-plate
SW/SWP 1	12	315	G 1/4	77 ... 90	40	40 ... 44	1.1 ... 1.5	0.6 ... 0.7
SW/SWP 2	25	315	G 3/8, G 1/4	78 ...- 82.5	60 ... 70	40 ... 45	1.1 ... 2.4	0.8
NSWP2			NG 6					

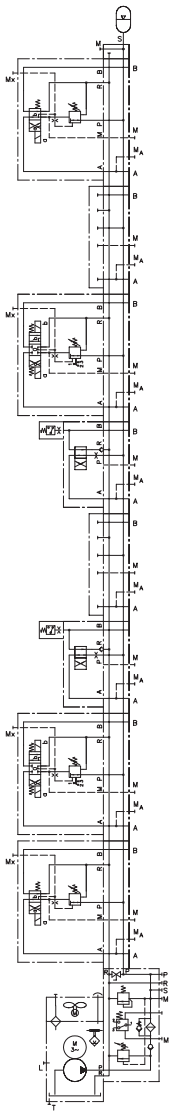
Circuit example 1:

BA2-A5 **-NSWP2G/M/03/NZP16V/PQ20/0**
-NSWP2G/M/R/B1,0
-NSWP2K/M/20/0
-NSWP2K/M/20/NZP16Q33/0
-2-L24



Circuit example 2:

HKF44V9LD/1-Z16
-AL21D10V-F60/80-2
-BA2-NSMD2K/G/B2/0
-NSMD2G/GRK/B2/0
-NSWP2W/M/B1.0/06/S/0
-NG6X/0
-NSWP2W/M/B1.0/06/S/0
-NSMD2G/GRK/B2/0
-NG6X/0
-NSMD2K/G/B2/0
-80-AC2001/40-X24



Combinable products:
- Valve bank type BA: Page 144
- Intermediate plate type NZP: D 7788 Z
- 6/2-directional spool valve: **Sk 7951-J-6/2**

Similar products:
- Valve banks type SWR and SWS: Page 76
- Clamping modules type NSMD: Page 100

Associated technical data sheets:
- Directional spool valve type SW: D 7451
- Directional spool valve type NSWP 2: D 7451 N

Male connectors:
- Line connector type MSD and others: D 7163
- With economy circuit: D 7813, D 7833

Directional spool valve

2.1 Directional spool valve bank type SWR and SWS

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers.
The directional spool valve bank type SWS is available with series connection. The consumers can be operated with on-off or proportional control. Versions are available for usage in potentially explosive atmospheres. By means of additional functions in the pump line, in the intermediate plates (longitudinal and sandwich valve combination) and ancillary blocks the directional spool valve bank can be flexibly adapted to different control tasks.
Intended applications include mobile hydraulics, in particular civil engineering, agricultural engineering and material handling.

Nomen-clature:	Directional spool valve
Design:	Valve bank Combination with hydraulic power packs
Actuation:	Solenoid
p_{max}:	315 bar
Q_{max}:	25 l/min

Features and benefits:

- Can be combined for forklift trucks with lifting modules
- Suitable for constant pressure systems
- Proportional movements can also be controlled independently of the load
- Extensive range of ancillary blocks
- Compact and extremely space-saving dimensions

Intended applications:

- Material handling
- Wind turbines
- Construction and construction materials
- Handling and assembly techn.
- Municipal trucks

Design and order coding example

SWR1 | A-6/230 | - GG | - 1 | - G24

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC
- Solenoids with various plug versions

End plate
- Additional ports P and/or R (P can be blocked)
- Idle circulation valve (ON/OFF, proportional)
- End spool valve

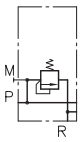
Valve sections
- Directional spool valve
- Additional options for the valve sections:
  - Options upstream (orifice, flow controller)
  - Consumer-side additional functions in ancillary block, e.g. double check valves, shock valves (load-holding valves etc.)

Connection block/adapter plate
- Pressure limiting valve (for pipe connection)
- Idle circulation valve
- 3-way flow controller

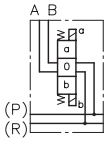
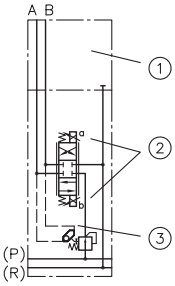
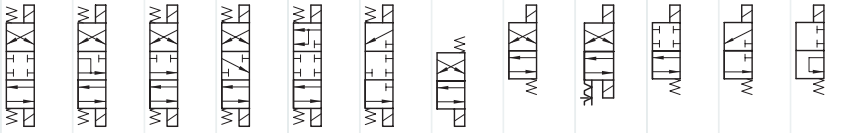
Basic type, size Type SWR 1 and SWS 2

Function

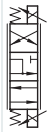
Connection blocks:

A 6	F/D
	
With fixed pressure limiting valve (for pipe connection)	For direct mounting onto hydraulic power packs (type KA, HC, MP, HK)

Valve sections:

Basic symbol		Symbol											
SWR 1	SWS 2	G	D	E	O	C	N	B	W	K	Q	R	U
													

Spool valves suited for prop. actuation

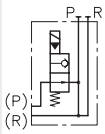
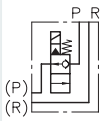
G	D
	

1 Ancillary block with additional function (on the consumer side)
2 Actuation
3 Additional function (on the pump side)

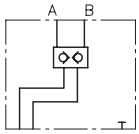
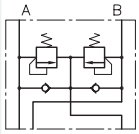
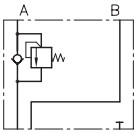
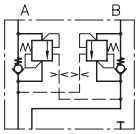
Additional versions for valve sections:

- b/w solenoids with stroke limitation
- prop. solenoids with stroke limitation
- solenoids also available in ATEX-compliant version (p_{max} = 210 bar)

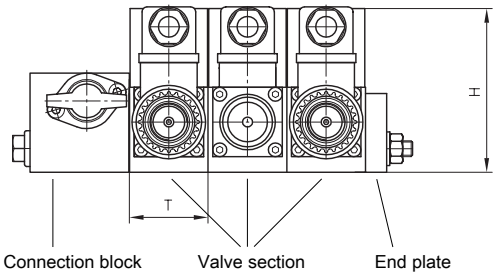
End plates (SWR 1/SWS 2):

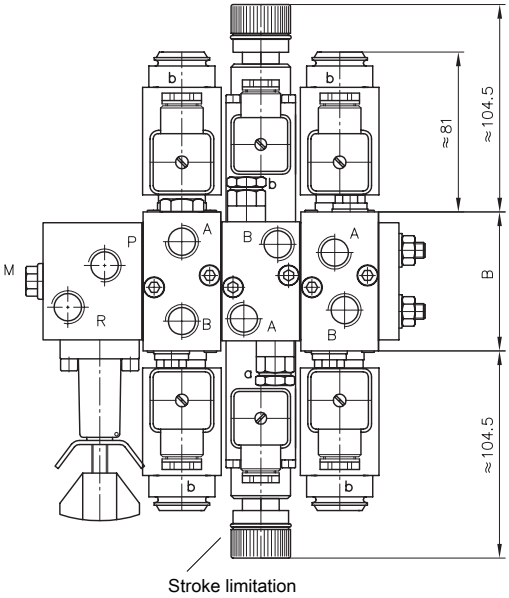
Series	With circulation valve	With lockable pump output
		

Ancillary block type SWS 2 with additional functions (consumer side):

Releasable check valve	Shock valve	Sequence valve	Over center valve
			

General parameters and dimensions





1 Connection block
2 Valve section
3 End plate
4 Stroke limitation

	Q_{max} [lpm]	p_{max} [bar]	Ports	Dimensions [mm]			m_{max} [kg]	
				H	B	T	Individual section	Connection block
SWR 1	12	315	G 1/4	77 - 90	40	40	1.1 - 1.5	0.6 - 0.7
SWS 2	25	315	G 3/8, G 1/4	78 - 82.5	60	40	1.1 - 2.4	0.8

Circuit example:

SWS 2 A 7/200

Valve bank type SWS, size 2, connection block with pressure-limiting valve (manually adjustable, set to 200 bar)

- G/M/2/2 RH

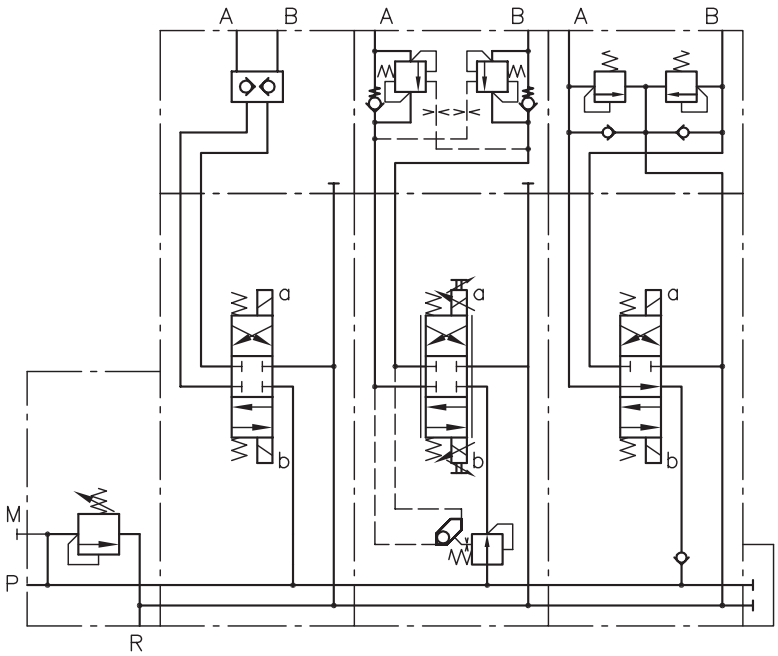
1. Valve section with circuit symbol G with solenoid actuation, no additional function in P gallery, with releasable check valves for A and B in the ancillary block

- G 10/MPF/DW/2 AL B 7/180 BLC 4/140

2. Valve section with circuit symbol G and proportional spool, max. flow rate A and B with 10 lpm, proportional solenoid MP with stroke limitation for A and B, pressure compensator in P gallery of the basic block (DW), ancillary block with load-holding valve for A (set to 180 bar) and for B (set to 140 bar)

- E/M/R/2 AN100 BN 100-1-G 24

3. Valve section with circuit symbol E and solenoid actuation, a check valve in the P gallery, ancillary block featuring shock and servo-suction valves for ports A and B (set to 100 bar), standard end plate, solenoid voltage 24V DC



Associated technical data sheets:

- Directional spool valve type SW: D 7451
- Directional spool valve bank type SWS: D 7951

Suited products for combination:

- Pressure switches type DG3.., DG5.E: Page 262

Similar products:

- Proportional directional spool valve type EDL: Page 82

Suitable male connectors:

- Line connector type MSD and others: D 7163
- With economy circuit: D 7813, D 7833/1
- Proportional amplifier type EV2S: Page 274

Directional spool valve

2.1 Directional spool valve type HSF

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers.
The directional spool valve type HSF is a manifold mounting valve. Due to the robust design, it reaches operating pressures of up to 400 bar.
Adjustable threaded throttles are used to adjust the response time. Harsh switching operations and decompression surges, particularly in the event of high pressure and large consumer volumes, can be avoided this way.

Features and benefits:

- Smooth switching for large flow rate
- Suitable for high pressures due to steel housing

Intended applications:

- Mining machinery (incl. oil production)
- Cranes and lifting equipment
- Construction and construction materials machinery
- Material handling (industrial trucks, etc.)

Nomen-clature:	Directional spool valve
Design:	Individual valve for manifold mounting
Actuation:	Electro-hydraulic Hydraulic
p_{max}:	400 bar
Q_{max}:	160 l/min

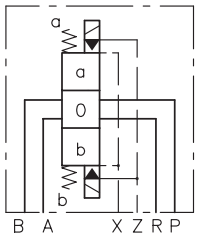
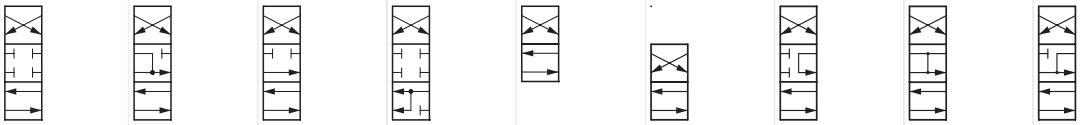
Design and order coding example

HSF4	/C321	- L	- 1	- G24	- 300

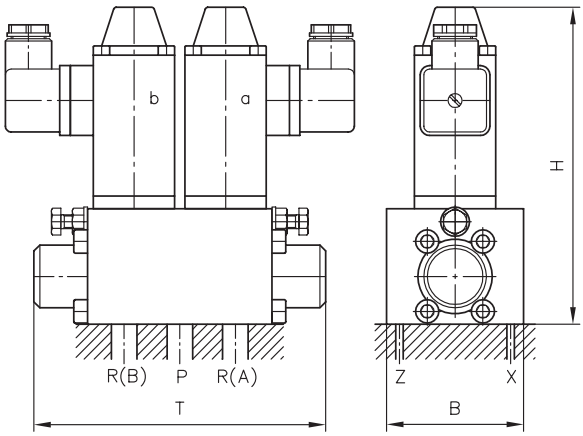
- **Pressure setting pressure limiting valve [bar]**
- **Solenoid voltage** 12V DC, 24V DC, 98V DC, 205V DC, 110V AC, 230V AC
- **End plate** Internal or external control oil return
- **Valve sections** With/without adjustable switching speed
- **Connection block**
  - With/without pressure limiting valve (Fixed or manually adjustable)
  - Internal or external control oil supply (max. 160 bar)
- **Basic type and size** Type HSF: Manifold mounting

Function

Valve sections:

Basic symbol	Symbol								
HSF	**G**	**D**	**E**	**C**	**W**	**B**	**L**	**H**	**F**
									
Manifold mounting valve	All flow pattern symbols also available with adjustable response time								

General parameters and dimensions



	Q_{max} [l/min]	p_{max} [bar]	Dimensions [mm]			m [kg]
			H	**B**	**T**	
HSF 3	80	400	137	59	126	2,8
HSF 4	160	400	157	70	184	5

Associated technical data sheets::

- Directional spool valve type PSL and PSV: D 7700-2; D 7700-3
- Directional spool valve type HSF: D 7493 E
- Directional spool valve type HSL: D 7493 L

Male connectors:

- Line connector type MSD and others: D 7163
- With economy circuit: D 7813, D 7833/1

Directional spool valve

2.1 Proportional directional spool valve type EDL

Proportional directional spool valves are a type of directional valve. They control the direction of movement and the velocity of individual or multiple hydraulic consumers actuated simultaneously. Control is independent of the load and continuous.
The directional spool valve type EDL with series connection is actuated directly. The flow rates for the individual consumers can be individually adjusted. The proportional directional spool valve can be flexibly adapted to different control tasks by means of additional functions in the intermediate plates and ancillary blocks.
The directional spool valve type EDL can be combined directly with the proportional directional spool valve type PSL and PSV in size 2 and is therefore suitable for constant and variable pump systems. It is used in mobile hydraulics, in particular in civil engineering and agricultural engineering.

Features and benefits:

- One valve for different control functions and small flow quantities
- Energy-saving closed-centre systems
- Compact and lightweight design
- Modular system can be directly combined with type PSL/PSV-2

Intended applications:

- Construction and construction materials machinery
- Cranes and lifting equipment
- Machines for forestry and agricultural purposes
- Municipal trucks

Nomenclature:	**Directly Prop. directional spool valves as per load-sensing principle**
Version:	**Valve bank in series connection**
Actuation:	**solenoid-actuated**
p_{max}:	**320 bar**
$Q_{max.\ consumer}$:	**48 l/min**
$Q_{pu\ max}$:	**100 l/min**

Design and order coding example

EDL - DA2 L 40/25 E /2 - G24

- **Solenoid voltage** 12V DC, 24V DC
  - Actuated via prop. amplifier or PLVC
- **Ancillary blocks**
- **Confirmation** Type E, EI
- **Volumetric flow** Volumetric flow indicator, side A, B (3...40)
- **Spool** Type L, H
- **Spool block** Section with inflow controller
- **Basic type** Type EDL: directly actuated proportional directional spool valve

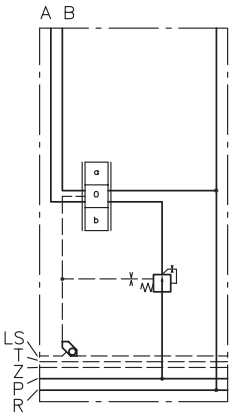
Function

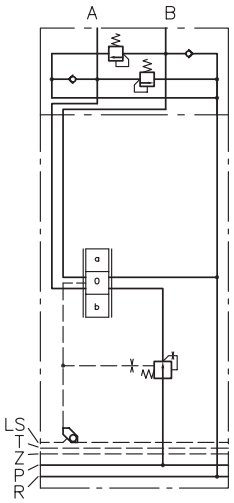
Valve sections:

Circuit symbol

L	H
	

Versions of valve sections:





Additional functions in the ancillary block:

- Shock and servo-suction valves
- Load-holding valves
- Check valves with release, no leakage
- Floating and block functions can be switched

Characteristic values for max. volumetric flows:

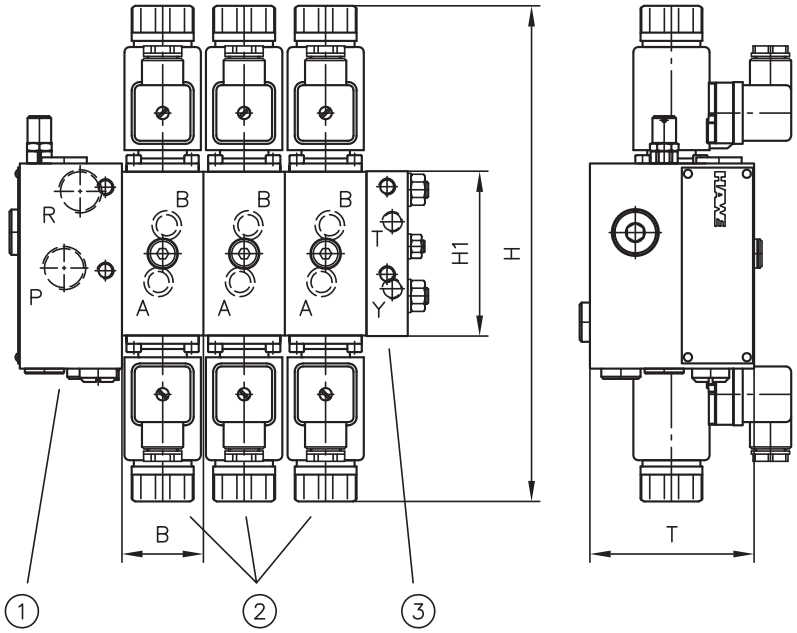
	$Q_{A, B}$				
Size 2	3	6	10	25	40

- Characteristic value corresponds to the max. volumetric flow [lpm] of inflow controller versions at the consumer ports A and/or B
- Volumetric flows for A and/or B can be selected separately

Actuations:

Basic type	Brief description	Circuit symbol (example)
E	electrical actuation with stroke limitation	
EI	electrical actuation without stroke limitation and with emergency manual actuation	

PSL/EDL



1 Connection block
2 Valve section
3 End plate

	Flow [lpm]		Oper. pressure [bar]	Ports		Dimensions [mm]				m [kg]
	Q_{max}	$Q_{pu\ max}$	p_{max}	P, R	A, B	H	H1	B	T	Per valve section[1)]
EDL	3 ... 40	80	320	G 1/2, 3/4-16 UNF-2B	G 3/8, 3/4-16 UNF-2B	241	80	40	64	1.8 ... 2.9

1) Dep. on actuation and additional functions

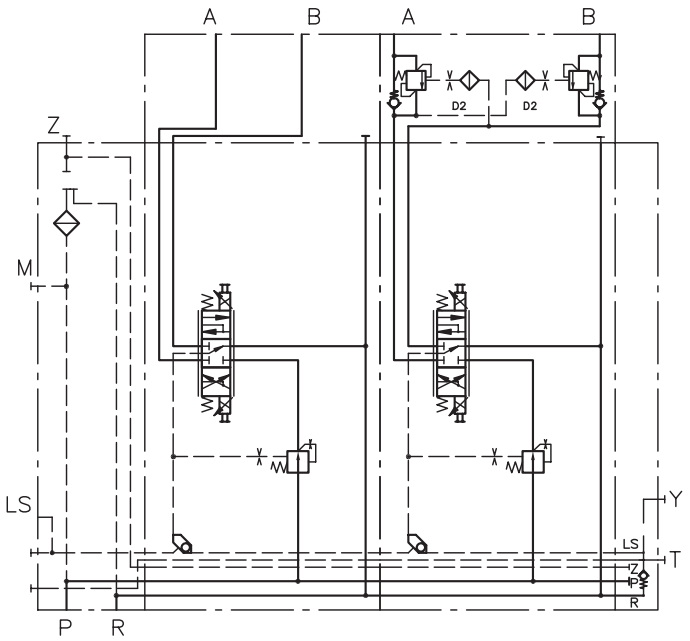
Circuit example:

PSV 3-2

- DA2L40/25/E/2

- DA2L25/16/E/24l-0-A4/210-Bl0-B4/210

- E4-G24



Associated technical data sheets:

- Proportional directional spool valve type EDL: D 8086
- Proportional directional spool valve, type PSL and PSV size 2: D 7700-2
- Proportional directional spool valve, type PSL, PSM and PSV size 3: D 7700-3
- Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5
- Connection block type HMPL and HMPV for proportional directional spool valve: D 7700 H

Directional spool valve

2.1 Clamping module type NSMD

Clamping modules combine a directional spool valve, pressure reducing valve and pressure switch.

The clamping module type NSMD has the standard connection pattern nominal size NG 6. It controls power-driven clamping devices, e.g. hydraulically-driven hollow and solid clamping cylinders for automatic lathes. It regulates the clamping pressure and monitors it. The clamping pressure is adjusted at the downstream pressure switch using a manual, mechanical or electrically-proportional adjustment device. A special safety circuit monitors the switching position of the valve.

Throttling options in the spool end position and/or rapid and creeping movements are possible as an additional function for one or both consumer ports. The clamping module type NSMD can be combined with other valves as a valve bank type BA to form a valve block.

Features and benefits:

- Directional valve, pressure-reducing valve and pressure switch in one device
- Adjustment of pressure-reducing valve and pressure switch with an adjustment device (manual or electro-proportional)
- The controlled pressure is picked up directly at the consumer port
- Valve with connection pattern in accordance with DIN 24340-A6

Intended applications:

- Machine tools (cutting)
- Machine tools (non-cutting) - forming and cutting
- Handling and mounting technology (industrial robots, etc.)

Nomen-clature:	**Valve combination consisting of:** ▪ **Directional spool valve (4/3-, 4/2-way function)** ▪ **Pressure reducing valve with tracked pressure switch**
Design:	**Individual valve for manifold mounting (Valve banks with sub-plates type BA are available)**
Actuation:	**Solenoid**
p_{max}:	**120 bar**
Q_{max}:	**25 l/min**

Design and order coding example

NSMD 2 | D1 | /MDA | /GRK | - G24

Solenoid voltage — 12V DC, 24V DC, 110V AC, 230V AC
Solenoids with various plug versions

Clamping pressure adjustment, pressure range, switching flow rate

- Slotted head screw + hexagon nut
- Wing screw + wing nut
- Lockable turning handle
- Electro-proportional adjustment with/without additional function monitoring

Actuation

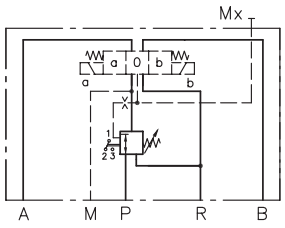
Function

- With pressure switch
- With orifice (flow limitation in accumulator mode)

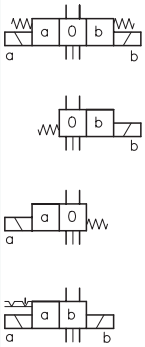
Basic type, size — Type NSMD size 2 with connection hole pattern conf. NG 6

Function

Basic symbols



D, E, G, D1, E1, G1



Symbols

D

D1

B, W, K

E

E1

B1, W1, K1

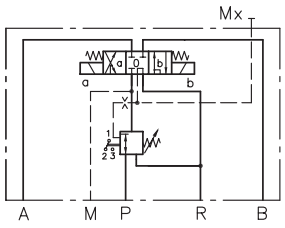
G

G1

Further functions:

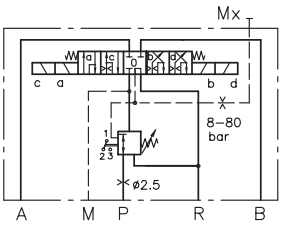
G1/MD

Pressure reducing function and throttle in switching positions a and b



G/MM6

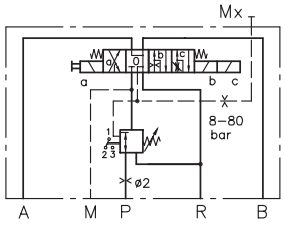
Rapid traverse and creeping in both directions



G/MMDA7

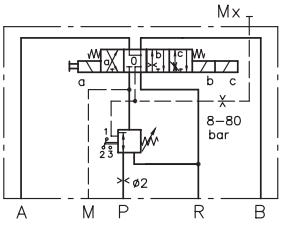
Rapid traverse and creeping in one direction featuring also a limitation for rapid traverse (switching position a, c) rapid traverse in opposing direction (switching position b)

Switching position a, speed limitation is possible by means of a throttle with pressure reduction and pressure monitoring

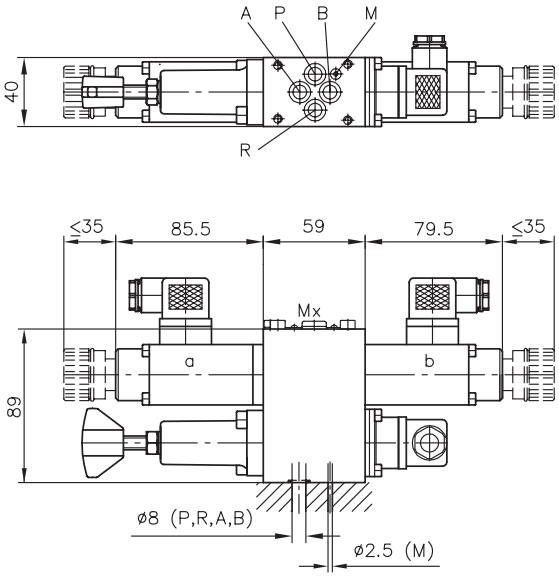


G/MMA7

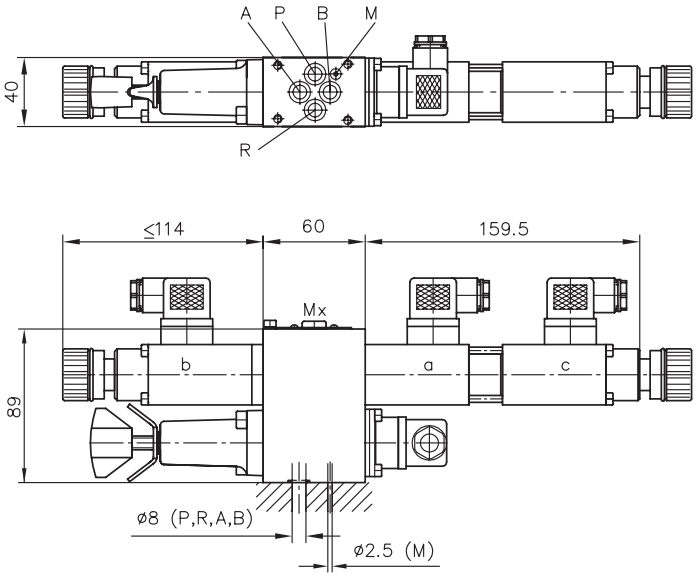
Switching position with fixed rapid traverse speed without pressure reduction and pressure monitoring.



NSMD2 K...



NSMD2 G...



	Q_{max} [lpm]	p_{max} [bar]	Clamping pressure range [bar]	Trigger flow [lpm]	Connection hole pattern[1]	Dimensions [mm]			m [kg]	
						H	B	T	Individual valve[2]	Additional function
NSMD2	25	120	H: 2 ... 17 A: 4 ... 36 G: 5 ... 50 B: 6 ... 60 E: 8 ... 80	1: 1 ... 3 -: 2 ... 4 3: 3 ... 5 4: 4 .. .6 5: 5 ... 7 6: 6 ....8 7: 7 ... 9	Hole pattern conf. DIN 24340-A6	see illustration			2.2 ... 3.8	+ 0.6 ... 1.1

1) Mx port: G 1/8
2) Depending on circuit symbol and actuation type

Circuit examples:

NSMD2K/M/GDK/B2.5-G24

Clamping module type NSMD size 2 with standard connection diagram in accordance with DIN 24340-A6, circuit symbol K, detented version, clamping pressure range G, 5-50 bar and min. switching flow rate 2-4 lpm. Clamping pressure adjustment with a tracked pressure switch is actuated using a wing bolt and wing nut.

A 2.5 mm ∅ orifice is present in the P gallery, 24V DC solenoid voltage.

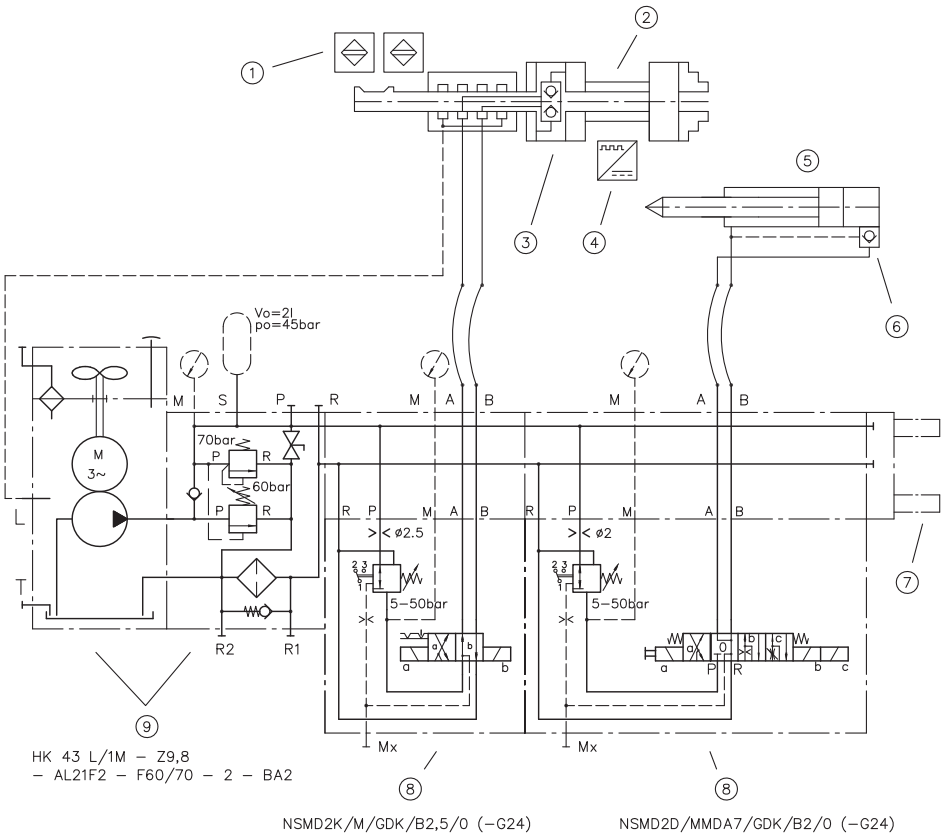
NSMD2G1/MD/E4VK/B1-G12

Clamping module type NSMD size 2 with standard connection diagram, in accordance with DIN 24340-A6, circuit symbol G1 with pressure monitoring at port A, adjustable throttle position for switching position a and b. Valve for clamping pressure range E, 8-80 bar and switching flow rate 4-6 lpm. Clamping pressure adjustment with a tracked pressure switch is actuated using a self-locking turn knob. A 1 mm ∅ orifice is present in the P gallery, 12V DC solenoid voltage.

Circuit example:

HK 43L/1M-Z 9,8-AL 21F2-F60/70-2-BA 2

- NSMD2K/M/GDK/B2,5/0
- NSMD2D/MMDA7/GDK/B2/0-G24



1 End position control
2 Clamping device
3 Releasable double check valve
4 Stand-still controller
5 Tailstock spindle
6 Releasable check valve
7 End plate
coding 11
8 Clamping module with sub-plate
9 Compact hydraulic power pack with connection block

Associated technical data sheets:

- Clamping module type NSMD: D 7787

Products:

- Directional valves type NSWP2: Page 72
- Directional seated valves type NBVP16: Page 134

Plates:

- Valve banks type BA2: Page 144
- Intermediate plate type NZP: D 7788 Z

Male connectors:

- Line connector type MSD and others: D 7163
- With economy circuit: D 7813, D 7833